

# 1 New Bad Runs

I observed during Run 48542, the High Voltage to the BWPC was off due to an isobutane problem, as noted in the elog records for March 29th. The voltage was turned back on but it appears that the chambers needed time to warm up or the voltage was not put to the optimal levels right away. This also effected RSSC for an even longer time. Need to determine if RSSC problems will affect analysis (not done yet).

The effects standard mix runs 48542,48543,48547. I have modified bad\_run\_02.function to remove these events during comis analysis.

$$KB_{Live} = 6.4 \times 10^9 \text{ (0.38\% of the total run).}$$

## 2 2-Beam KK Rejection study

In the original 2Bm KK Rejection study 58 events survived to the end. I scanned all 58 and classified them to determine if in fact they are 2beam.

Overall breakdown

type	no of events	comments
bad run	1	BWPC off
kpigap	19	all 18 are kinks and 1 is a possible kink, not a 2bm.
+tgzfool	22	events that fail $tgz < -5$ (tgzfool for 787) but pass 949 level of $tgz < -15$ .
kinks	4	Did not get removed by kpi_gap.
KIC	1	Event starts in RS and passes thru TG and triggers t*2 on opposite side.
unknown	2	I need to investigate further, but for now I would say they are 2bm)
2beam	8	does not include ones removed by tgzfool/kpigap
Total Events	58	I know one event is missing, has anyone seen an event laying around?

Table 1: Break down of events that survive 2-beam KK rejection cuts.

### 3 Kpi\_gap function

The kpi<sub>gap</sub> is intended to replace the inverted targf in the 2-beam rejection bifurcation. PNN2 inverts targf when we tag for a 2nd hit in the b4 at trs. We need to do this to remove non-2beam events that are tagged by observing a 2nd hit at b4-trs. These events include  $K_{e4}$  and others where the decay product of the kaon in the target produces a hit in the b4 instead of an incoming 2nd beam particle.

After scanning these 58 events, I noticed many target scatters in which a decay product triggers the b4-trs hit. So I created this function as a tighter version of  $\overline{\text{targf}}$  to apply instead. Below is an example that is removed from the 2-beam KK rejection sample when we use kpi<sub>gap</sub>.

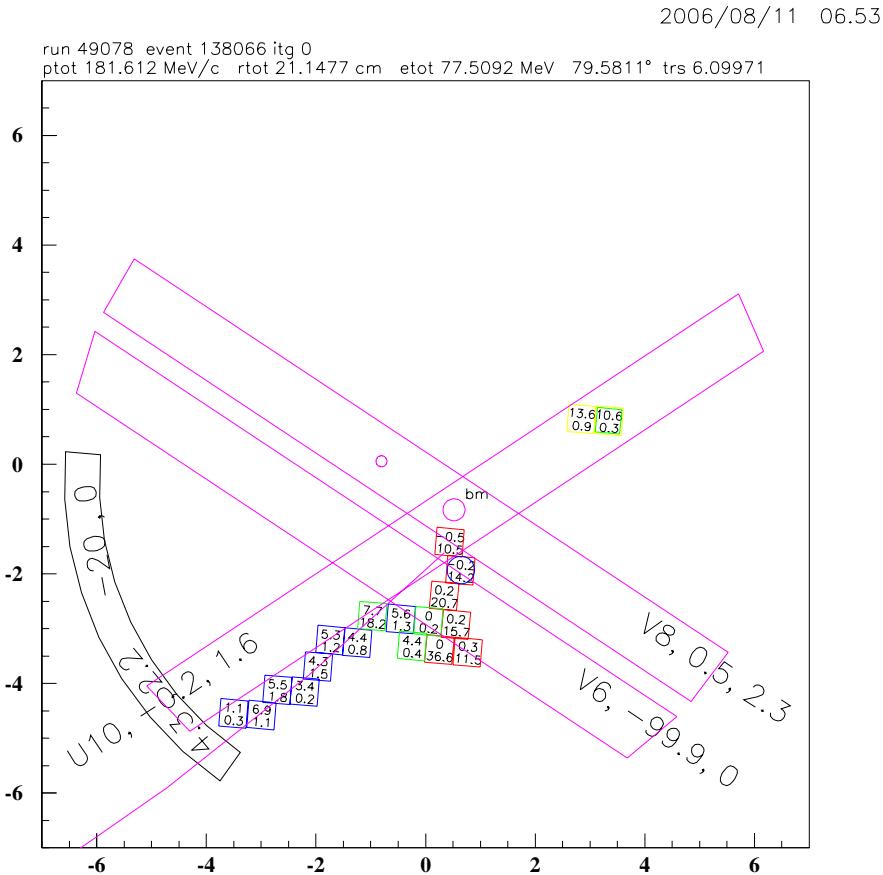


Figure 1: Example of a Scatter event that will be removed by kpi<sub>gap</sub>.

Original Latex file created on 17Aug06\_1249 and Modified on August 17, 2006.  
Numbers in tables created on unknown unknown unknown.  
Data processed in Dec 2005 - Jan 2006.  
This data has been skimmed from PNN2-ntuples with the following cuts: OR of 1/3 skims,  
BAD\_RUN, (BOX2 or boxcuts), RSDEDXMAX, RSDEDXCL on the PNN2\_SKIM set.

The title of a column describes the data set used.

pnn2 = PNN1+PNN2 data with the most up-to-date cuts applied.

pnn1 = PNN1 data with the most up-to-date cuts applied.

pnn2only = PNN2 data with the most up-to-date cuts applied.

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Tables 1-5 are a summary of the long tables that follow.

The long tables track the events on a cut-by-cut basis. There are 3 columns per data set analyzed. In each column the first number in the cell is the number of events and the number in parenthesis is the rejection. The 1st column is the cuts applied sequentially; the 2nd is the application of only the listed cut; The 3rd is the number of events remaining before this cut is applied and the rejection of the cut.

Some cuts may have 787, 949, or cur attached to them. That means that the cut is set at the e787-pnn2, e949-pnn1, or the current e949-pnn2 level. Note that many of the cuts labeled cur are more than likely to be a carry over from e949-pnn1.

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<i>rejection (n)</i>	2bmrej	kpigap	gaptgz
<i>Loose Setup</i>	$13164.0 \pm 9308.0$ (2)	$13164.0 \pm 9308.0$ (2)	$10230.5 \pm 7233.7$ (2)
<i>TD</i>	$7818.0 \pm 5527.8$ (2)	$7818.0 \pm 5527.8$ (2)	$6105.5 \pm 4316.9$ (2)
<i>TD · KIN</i>	$4907.0 \pm 4906.5$ (1)	$4907.0 \pm 4906.5$ (1)	$3895.0 \pm 3894.5$ (1)

Table 2: **1-Beam Rejection Summary** of Tables 6-8. Each row is a different branch to measure the DELCO rejection. First number is the rejection. The number in parenthesis is the number of events remaining that the rejection is based upon. The minimum rejection is used in calculation of the 1-BM background for a conservative estimate.

<i>Norm. branches</i>	2bmrej	kpigap	gaptgz
<b>ALL cuts below NORM</b>	$1.0 \pm 1.0$	$1.0 \pm 1.0$	$1.0 \pm 1.0$
<i>PV · TD norm</i>	$5.0 \pm 2.2$	$5.0 \pm 2.2$	$4.0 \pm 2.0$
<i>CkTRS · CkTail rej</i>	$4.2 \pm 1.2$	$4.2 \pm 1.2$	$4.4 \pm 1.3$
<i>B4DEDX norm</i>	$1.0 \pm 1.0$	$1.0 \pm 1.0$	$1.0 \pm 1.0$
<i>CpiTRS · CpiTail rej</i>	$0.0 \pm 0.0$	$0.0 \pm 0.0$	$0.0 \pm 0.0$
$N_K$	$1.6 \pm 0.8$	$1.6 \pm 0.8$	$1.2 \pm 0.7$
$N_{pi}$	$99999.0 \pm 19999.8$	$99999.0 \pm 19999.8$	$99999.0 \pm 24999.8$

Table 3: **1-Beam Normalization Summary** of Tables 9-13. The ALL-cuts-below row uses the combination of all cuts in the following 4 rows (branches) and is the normalization number used in the calculation of the numbers reported in Table 5 (Total Background). The sum of the last two rows provide a check on the ALL-cuts-below number.

<i>rejection (n)</i>	2bmrej	kpigap	gaptgz
$Rej_{K-K} : BWTRS \cdot CkTRS \cdot CkTail$	$30.0 \pm 3.9$ (57)	$40.2 \pm 6.4$ (38)	$38.3 \pm 9.5$ (16)
$Rej_{K-pi} : BWTRS \cdot CpiTRS \cdot CpiTail$	$105.4 \pm 20.6$ (26)	$188.8 \pm 52.2$ (13)	$243.7 \pm 81.1$ (9)

Table 4: **2-Beam Rejection Summary** of Tables 14-15. First number is the rejection. The number in parenthesis is the number of events remaining that the rejection is based upon. K-K is the case where two Kaons are entering the beam. K-pi is the case where we have a Kaon and a Pion entering.  $\overline{B4TRS \cdot B4CCD}$  is applied.

<i>Norm. branches</i>	2bmrej	kpigap	gaptgz
$K-K_n : B4TRS \cdot B4CCD$	$1.0 \pm 1.0$	$1.0 \pm 1.0$	$1.0 \pm 1.0$
$K-K_r : TG \cdot TGKIN \cdot TGPV$	$4.0 \pm 3.5$	$4.0 \pm 3.5$	$2.0 \pm 1.4$
$K-pi_n : B4TRS \cdot B4CCD$	$1.0 \pm 1.0$	$1.0 \pm 1.0$	$1.0 \pm 1.0$
$K-pi_r : TG \cdot TGKIN \cdot TGPV$	$15.0 \pm 14.5$	$15.0 \pm 14.5$	$12.0 \pm 11.5$
$N_{K-K}$	$0.2 \pm 0.3$	$0.2 \pm 0.3$	$0.5 \pm 0.6$
$N_{K-pi}$	$0.1 \pm 0.1$	$0.1 \pm 0.1$	$0.1 \pm 0.1$

Table 5: **2-Beam Normalization Summary** of Tables 16-19. The 2-BM Normalization has 2 branches that are further bifurcated.  $K-K_{r,n}$ ,  $K-pi_{r,n}$  are the results of the bifurcations, r=rejection, n=normalization, which we used to determine the last two rows.  $N_{K-K}$  and  $N_{K-pi}$  are the 2-BM normalization values which are used in combination with Table 3 to give the final background in Table 5. For KK (Kpi),  $\overline{CkTRS \cdot CkTAIL \cdot BWTRS}$  ( $\overline{CpiTRS \cdot CpiTAIL \cdot BWTRS}$ ) is applied

<i>Bkgrnd</i> ( $\times 10^{-3}$ )	k034	e787	2bmrej	kpigap	gaptgz
1-BM	$3.86 \pm 2.36$	$1.66 \pm 1.66$	$0.61 \pm 0.61$	$0.61 \pm 0.61$	$0.77 \pm 0.77$
2-BM KK	$0.983 \pm 0.983$	$145.9 \pm 145.9$	$24.98 \pm 33.21$	$18.64 \pm 24.84$	$39.15 \pm 48.92$
2-BM Kpi	$0.106 \pm 0.106$	$19.7 \pm 19.7$	$1.90 \pm 2.66$	$1.06 \pm 1.50$	$1.03 \pm 1.46$
2-BM	$1.14 \pm 1.14$	$165.6 \pm 165.6$	$26.88 \pm 26.88$	$19.70 \pm 19.70$	$40.18 \pm 40.18$
Total	$5.00 \pm 2.62$	$167.3 \pm 167.3$	$27.49 \pm 27.49$	$20.31 \pm 20.31$	$40.95 \pm 40.95$

Table 6: **Total Background.** Scaled to the 3/3 sample. k034 column is the result of e949-pnn1 analysis. e787 is the result of the e787-PNN2 analysis. The other columns are current results that are expanded upon throughout the rest of the tables. The errors are statistical.  $KB_{live}$  for k034 is  $1.77 \times 10^{12}$  and for e787 is  $1.71 \times 10^{12}$ . e787 background has been scaled up accordingly for comparison purposes.

Table 7: 2-Beam Rejection. Branch no. 1

Cuts	2bmrej seq	2bmrej single	2bmrej allbut	kpigap seq	kpigap single	kpigap allbut	gaptgz seq	gaptgz single	gaptgz allbut
<i>BOX</i>	757265 (0.00)	0 (757265.00)	57 (1.00)	757279 (0.00)	0 (757279.00)	38 (1.00)	757279 (0.00)	0 (757279.00)	16 (1.00)
<i>rsdedxmax</i>	757265 (1.00)	0 (757265.00)	57 (1.00)	757279 (1.00)	0 (757279.00)	38 (1.00)	757279 (1.00)	0 (757279.00)	16 (1.00)
<i>rsdedxcl</i>	757265 (1.00)	0 (757265.00)	57 (1.00)	757279 (1.00)	0 (757279.00)	38 (1.00)	757279 (1.00)	0 (757279.00)	16 (1.00)
<i>rslike</i>	757265 (1.00)	0 (757265.00)	57 (1.00)	757279 (1.00)	0 (757279.00)	38 (1.00)	757279 (1.00)	0 (757279.00)	16 (1.00)
<i>rngmom</i>	535718 (1.41)	221547 (3.42)	59 (1.04)	535731 (1.41)	221548 (3.42)	40 (1.05)	535731 (1.41)	221548 (3.42)	17 (1.06)
<i>pv(not tg)</i>	285238 (1.88)	324689 (2.33)	396 (6.95)	285245 (1.88)	324695 (2.33)	203 (5.34)	285245 (1.88)	324695 (2.33)	114 (7.12)
<i>piflg</i>	284146 (1.00)	25722 (29.44)	57 (1.00)	284153 (1.00)	25722 (29.44)	38 (1.00)	284153 (1.00)	25722 (29.44)	16 (1.00)
<i>ev502</i>	225415 (1.26)	216194 (3.50)	57 (1.00)	225419 (1.26)	216199 (3.50)	38 (1.00)	225419 (1.26)	216199 (3.50)	16 (1.00)
<i>elveto</i>	205920 (1.09)	183185 (4.13)	57 (1.00)	205924 (1.09)	183187 (4.13)	38 (1.00)	205924 (1.09)	183187 (4.13)	16 (1.00)
<i>tdfool</i>	205422 (1.00)	133121 (5.69)	57 (1.00)	205426 (1.00)	133123 (5.69)	38 (1.00)	205426 (1.00)	133123 (5.69)	16 (1.00)
<i>tdvarnn02</i>	168101 (1.22)	281057 (2.69)	57 (1.00)	168104 (1.22)	281062 (2.69)	38 (1.00)	168104 (1.22)	281062 (2.69)	16 (1.00)
<b>TD</b>	168101 (1.00)	429649 (1.76)	57 (1.00)	168104 (1.00)	429657 (1.76)	38 (1.00)	168104 (1.00)	429657 (1.76)	16 (1.00)
<i>b4dedx</i>	88481 (1.90)	210858 (3.59)	63 (1.11)	88482 (1.90)	210864 (3.59)	42 (1.11)	88482 (1.90)	210864 (3.59)	17 (1.06)
<i>tgqualt</i>	80995 (1.09)	54118 (13.99)	57 (1.00)	80996 (1.09)	54119 (13.99)	38 (1.00)	80996 (1.09)	54119 (13.99)	16 (1.00)
<i>timcon</i>	80103 (1.01)	8896 (85.12)	57 (1.00)	80104 (1.01)	8896 (85.13)	38 (1.00)	80104 (1.01)	8896 (85.13)	16 (1.00)
<i>DELC(0.)</i>	21577 (3.71)	539784 (1.40)	67 (1.18)	21577 (3.71)	539794 (1.40)	46 (1.21)	21577 (3.71)	539794 (1.40)	19 (1.19)
<i>tger</i>	20120 (1.07)	20588 (36.78)	61 (1.07)	20120 (1.07)	20590 (36.78)	42 (1.11)	20120 (1.07)	20590 (36.78)	16 (1.00)
<i>tgzfool</i>	19884 (1.01)	12219 (61.97)	58 (1.02)	19884 (1.01)	12221 (61.97)	39 (1.03)	13506 (1.49)	191717 (3.95)	39 (2.44)
<i>upvtrs</i>	17670 (1.13)	60253 (12.57)	58 (1.02)	17670 (1.13)	60254 (12.57)	39 (1.03)	12065 (1.12)	60254 (12.57)	16 (1.00)
<i>rvtrs</i>	17318 (1.02)	15383 (49.23)	61 (1.07)	17318 (1.02)	15383 (49.23)	40 (1.05)	11930 (1.01)	15383 (49.23)	16 (1.00)
<i>b4etcon</i>	16913 (1.02)	23422 (32.33)	58 (1.02)	16913 (1.02)	23424 (32.33)	39 (1.03)	11719 (1.02)	23424 (32.33)	17 (1.06)
<i>b4trs · b4ccd AND targf</i>	7909 (2.14)	707894 (1.07)	971 (17.04)	7157 (2.36)	713534 (1.06)	971 (25.55)	4169 (2.81)	713534 (1.06)	891 (55.69)
<i>cpitrs</i>	2285 (3.46)	315309 (2.40)	72 (1.26)	2048 (3.49)	315320 (2.40)	52 (1.37)	873 (4.78)	315320 (2.40)	26 (1.62)
<i>cpitail</i>	2279 (1.00)	56049 (13.51)	57 (1.00)	2045 (1.00)	56049 (13.51)	38 (1.00)	870 (1.00)	56049 (13.51)	16 (1.00)
$1.1 < b4ars\_atc < 5.0$	<b>1711</b> (1.33)	400912 (1.89)	92 (1.61)	<b>1529</b> (1.34)	400923 (1.89)	58 (1.53)	<b>613</b> (1.42)	400923 (1.89)	25 (1.56)
<i>bwtrs</i>	88 (19.44)	176029 (4.30)	94 (1.65)	67 (22.82)	176033 (4.30)	72 (1.89)	24 (25.54)	176033 (4.30)	28 (1.75)
<i>cktrs</i>	60 (1.47)	265253 (2.85)	65 (1.14)	41 (1.63)	265254 (2.85)	46 (1.21)	17 (1.41)	265254 (2.85)	17 (1.06)
<i>cktail</i>	<b>57</b> (1.05)	169365 (4.47)	60 (1.05)	<b>38</b> (1.08)	169366 (4.47)	41 (1.08)	<b>16</b> (1.06)	169366 (4.47)	17 (1.06)
Total Rej.		30.02			40.24				38.31

Table 8: 2-Beam Rejection. Branch no. 2

Cuts	2bmrej seq	2bmrej single	2bmrej allbut	kpigap seq	kpigap single	kpigap allbut	gaptgz seq	gaptgz single	gaptgz allbut
<i>BOX</i>	757265 (0.00)	0 (757265.00)	26 (1.00)	757279 (0.00)	0 (757279.00)	13 (1.00)	757279 (0.00)	0 (757279.00)	9 (1.00)
<i>rsdedxmax</i>	757265 (1.00)	0 (757265.00)	26 (1.00)	757279 (1.00)	0 (757279.00)	13 (1.00)	757279 (1.00)	0 (757279.00)	9 (1.00)
<i>rsdedxcl</i>	757265 (1.00)	0 (757265.00)	26 (1.00)	757279 (1.00)	0 (757279.00)	13 (1.00)	757279 (1.00)	0 (757279.00)	9 (1.00)
<i>rslike</i>	757265 (1.00)	0 (757265.00)	26 (1.00)	757279 (1.00)	0 (757279.00)	13 (1.00)	757279 (1.00)	0 (757279.00)	9 (1.00)
<i>rngmom</i>	535718 (1.41)	221547 (3.42)	27 (1.04)	535731 (1.41)	221548 (3.42)	14 (1.08)	535731 (1.41)	221548 (3.42)	10 (1.11)
<i>pv(not tg)</i>	285238 (1.88)	324689 (2.33)	303 (11.65)	285245 (1.88)	324695 (2.33)	107 (8.23)	285245 (1.88)	324695 (2.33)	94 (10.44)
<i>piflg</i>	284146 (1.00)	25722 (29.44)	26 (1.00)	284153 (1.00)	25722 (29.44)	13 (1.00)	284153 (1.00)	25722 (29.44)	9 (1.00)
<i>ev502</i>	225415 (1.26)	216194 (3.50)	26 (1.00)	225419 (1.26)	216199 (3.50)	13 (1.00)	225419 (1.26)	216199 (3.50)	9 (1.00)
<i>elveto</i>	205920 (1.09)	183185 (4.13)	26 (1.00)	205924 (1.09)	183187 (4.13)	13 (1.00)	205924 (1.09)	183187 (4.13)	9 (1.00)
<i>tdfool</i>	205422 (1.00)	133121 (5.69)	26 (1.00)	205426 (1.00)	133123 (5.69)	13 (1.00)	205426 (1.00)	133123 (5.69)	9 (1.00)
<i>tdvarnn02</i>	168101 (1.22)	281057 (2.69)	26 (1.00)	168104 (1.22)	281062 (2.69)	13 (1.00)	168104 (1.22)	281062 (2.69)	9 (1.00)
<b>TD</b>	168101 (1.00)	429649 (1.76)	26 (1.00)	168104 (1.00)	429657 (1.76)	13 (1.00)	168104 (1.00)	429657 (1.76)	9 (1.00)
<i>b4dedx</i>	88481 (1.90)	210858 (3.59)	27 (1.04)	88482 (1.90)	210864 (3.59)	14 (1.08)	88482 (1.90)	210864 (3.59)	10 (1.11)
<i>tqqualt</i>	80995 (1.09)	54118 (13.99)	26 (1.00)	80996 (1.09)	54119 (13.99)	13 (1.00)	80996 (1.09)	54119 (13.99)	9 (1.00)
<i>timcon</i>	80103 (1.01)	8896 (85.12)	26 (1.00)	80104 (1.01)	8896 (85.13)	13 (1.00)	80104 (1.01)	8896 (85.13)	9 (1.00)
<i>DELC(0.)</i>	21577 (3.71)	539784 (1.40)	30 (1.15)	21577 (3.71)	539794 (1.40)	14 (1.08)	21577 (3.71)	539794 (1.40)	10 (1.11)
<i>tger</i>	20120 (1.07)	20588 (36.78)	27 (1.04)	20120 (1.07)	20590 (36.78)	14 (1.08)	20120 (1.07)	20590 (36.78)	10 (1.11)
<i>tgzfool</i>	19884 (1.01)	122119 (61.97)	26 (1.00)	19884 (1.01)	12221 (61.97)	13 (1.00)	13506 (1.49)	191717 (3.95)	13 (1.44)
<i>upvtrs</i>	17670 (1.13)	60253 (12.57)	28 (1.08)	17670 (1.13)	60254 (12.57)	14 (1.08)	12065 (1.12)	60254 (12.57)	10 (1.11)
<i>rvtrs</i>	17318 (1.02)	15383 (49.23)	26 (1.00)	17318 (1.02)	15383 (49.23)	13 (1.00)	11930 (1.01)	15383 (49.23)	9 (1.00)
<i>b4etccon</i>	16913 (1.02)	23422 (32.33)	26 (1.00)	16913 (1.02)	23424 (32.33)	13 (1.00)	11719 (1.02)	23424 (32.33)	9 (1.00)
<i>b4trs · b4ccd AND targf</i>	7909 (2.14)	707894 (1.07)	1469 (56.50)	7157 (2.36)	713534 (1.06)	1469 (113.00)	4169 (2.81)	713534 (1.06)	1434 (159.33)
<i>cktrs</i>	5769 (1.37)	265253 (2.85)	29 (1.12)	5213 (1.37)	265254 (2.85)	15 (1.15)	3330 (1.25)	265254 (2.85)	11 (1.22)
<i>cktai</i>	5695 (1.01)	169365 (4.47)	27 (1.04)	5146 (1.01)	169366 (4.47)	14 (1.08)	3301 (1.01)	169366 (4.47)	10 (1.11)
<i>b4ars_atc &lt; 1.1</i>	3238 (1.76)	362342 (2.09)	61 (2.35)	2931 (1.76)	362345 (2.09)	30 (2.31)	2193 (1.51)	362345 (2.09)	25 (2.78)
<i>tzg &gt; -7.0</i>	<b>2741</b> (1.18)	123135 (6.15)	32 (1.23)	<b>2454</b> (1.19)	123140 (6.15)	18 (1.38)	<b>2193</b> (1.00)	123140 (6.15)	9 (1.00)
<i>bwtrs</i>	57 (48.09)	176029 (4.30)	70 (2.69)	40 (61.35)	176033 (4.30)	50 (3.85)	35 (62.66)	176033 (4.30)	41 (4.56)
<i>cpirs</i>	26 (2.19)	315309 (2.40)	47 (1.81)	13 (3.08)	315320 (2.40)	31 (2.38)	9 (3.89)	315320 (2.40)	27 (3.00)
<i>cpi tail</i>	<b>26</b> (1.00)	56049 (13.51)	26 (1.00)	<b>13</b> (1.00)	56049 (13.51)	13 (1.00)	<b>9</b> (1.00)	56049 (13.51)	9 (1.00)
Total Rej.		105.42			188.77			243.67	